**U.S. Army Research, Development and Engineering Command**



# C3Grid Overview
**DoD M&S Conference**
**10 March 2008**

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- The real world Army is organized into well defined hierarchies with roles and responsibilities articulated and understood.

- Communication in the real world occurs over real equipment.  It is well defined with a purpose and an intended effect.

- Decisions are made based on information and understanding – situational awareness

- The C3Grid enables MATREX to simulate information age operational realities – the force structure and information flows that are the challenges of the future Army concept

- The fidelity of the C3Grid and the services associated with the C3Grid impacts the degree to which the simulated world replicates the real world.

- The  degree to which the real world and the simulated world can interoperate depends on the ability of each to impact the other; i.e., their ability to communicate with each other.

*TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.*

- Provides robust highly parametric C4ISR modeling capability for Network Centric Warfare (NCW) that enables the use of existing combat simulations to support Army transformation.

- Creates and allows representation of information flow topologies unique to message type, decision points and data processes.

- Interface for management of the Common Operating Picture (COP) for the force structure according to information flow using blue/red deconfliction, target correlation, aggregation and information dissemination.

- Interfaces for integration of external services including communication effects, fusion, human performance modeling and Command & Control devices.

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

**RDECOM**

**MATREX**

1101
1104
C2 Vehicle
1105
1103
Detection
1102

**Entity Updates**

**Perception update**

**Reporting Topologies**

**Workflow Processes**

**Comms Effects**

**C3 Grid Software Components**

**HPM for particular Platform(s)**

**Human Performance Model (C3 HPM)**

**Logical comm:** "A" talks to "B"

**Success of Transmission**

**SA Data**

**Orders**

**COMMUNICATION EFFECTS (ALCES, LSI SNT CES, etc.)**

**C2 Device display Of platform SA data**

**Physical comm:** "A" talks to "B" using SATCOM and two radio hops

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

- Enables the modeling of the *propagation and maintenance* of situational awareness (SA) as it originates from the simulated battlefield
  - Converts data from battlefield simulations into reported / detected information
  - Models the reporting of that information from the detecting/reporting platform to other platforms via defined reporting hierarchies
  - Maintains information about known entities (friendly & enemy) on behalf of the simulation(s) modeling the battlefield entities

**Data inputs define the desired SA reporting Topology**



C2 Vehicle

C2 Vehicle

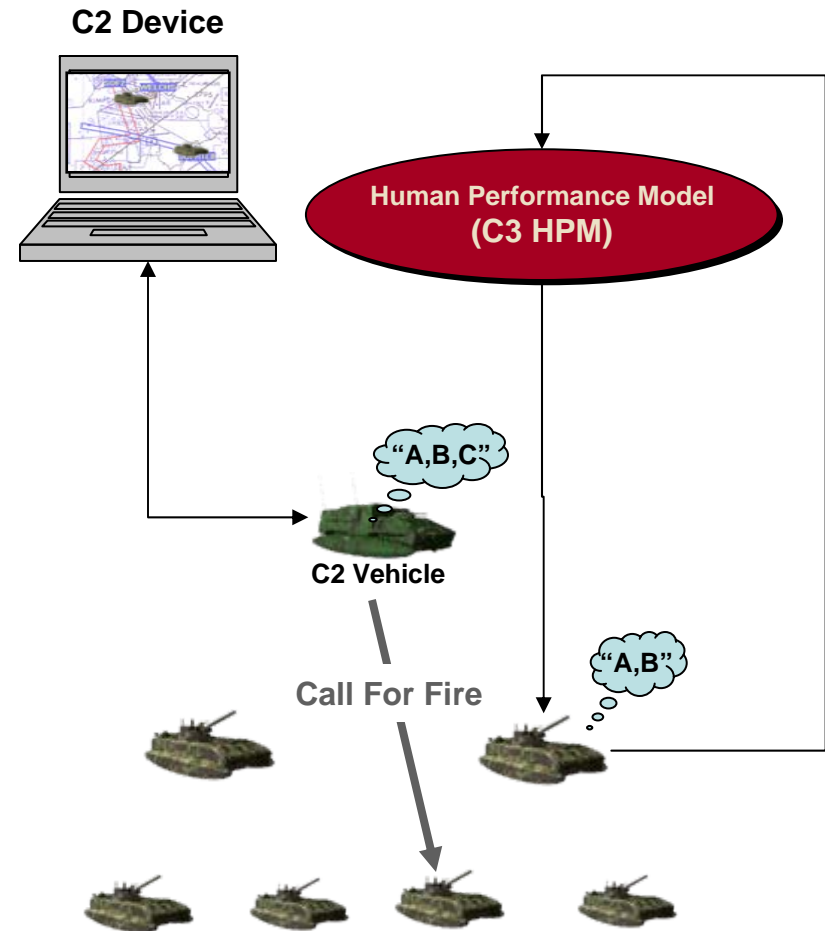*TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.*
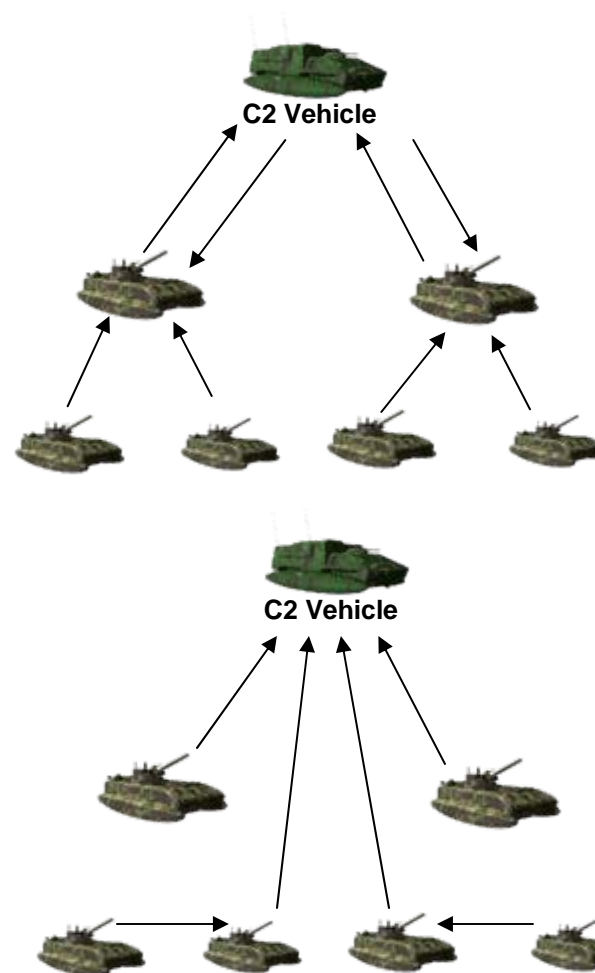
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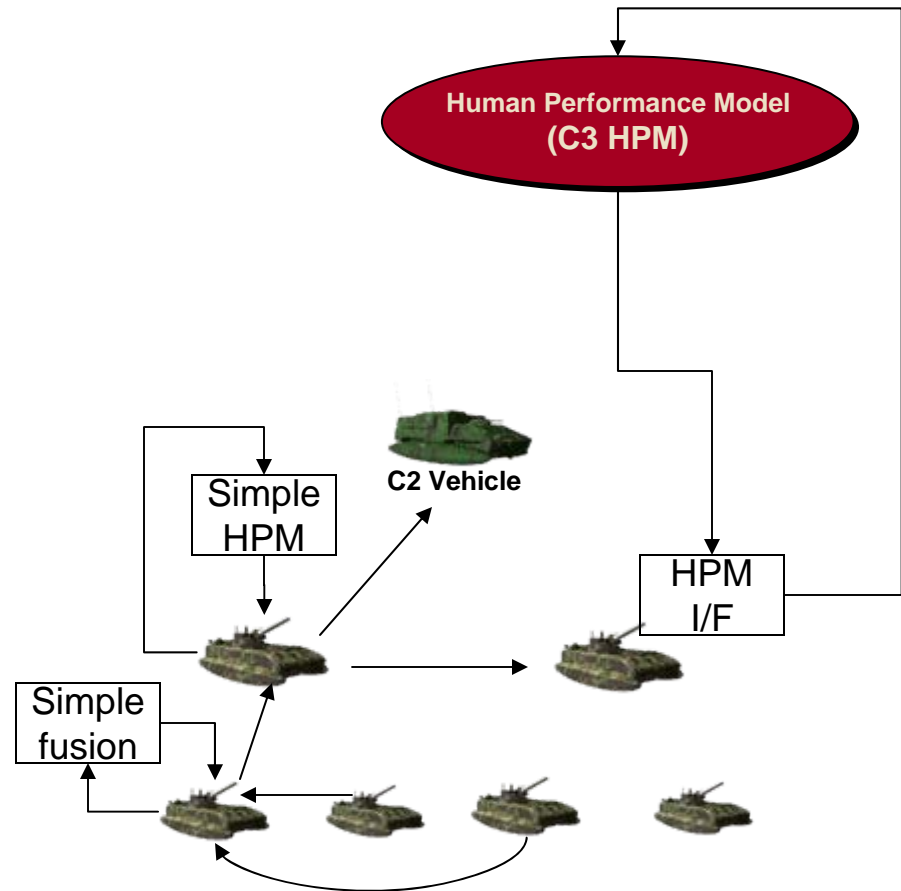
**C2 Vehicle**
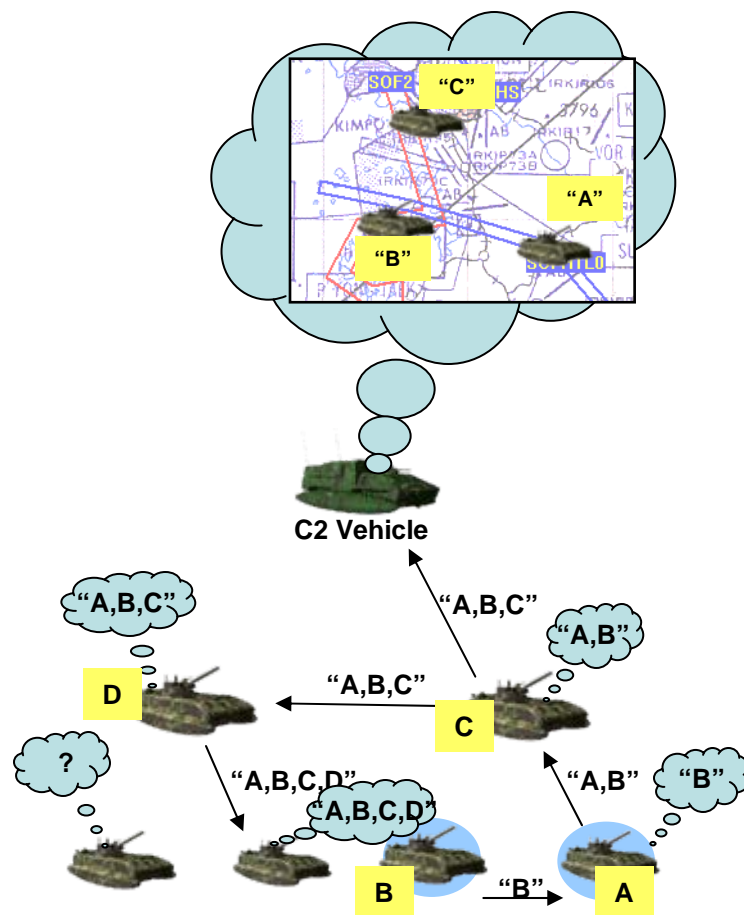
**Notional SITREP reporting topology**

TECHNOLOGY DRIVEN. **WARFIGHTER FOCUSED.**

- Conveys SA information to external components as appropriate
  - C2 Devices with human operators
  - Simulations modeling C2 constructive behaviors
- Enables the sending of other (non-SA) messages/orders between battlefield entities
  - e.g., Call for Fire (CFF) from requesting unit to the authorizing unit

**C2 Device**

**Human Performance Model (C3 HPM)**

"A,B,C"

**C2 Vehicle**

"A,B"

**Call For Fire**

TECHNOLOGY DRIVEN. **WARFIGHTER FOCUSED.**

- Models surrogate fusion and HPM processing
  - Surrogate, organic Human Performance Model (HPM) for message processing
  - Surrogate, organic message fusion
- Provides *interfaces* to external processing
  - Provides interfaces to external, higher-fidelity representations as desired

Human Performance Model (C3 HPM)

Simple HPM

C2 Vehicle

HPM I/F

Simple fusion

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

- Models surrogate *message communications effects*
  - simple message delays
  - "perfect" – no delays

- Provides an interface to external, higher-fidelity Communications Effects Server (CES) representation as needed

- Can apply comms effects equally to all "communicated" messages (SA, CFF, Fire missions, orders, …)

**COMMUNICATION EFFECTS (ALCES, SNT LSI CES)**

**C2 Vehicle**

Simple Comm effects

CES I/F

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
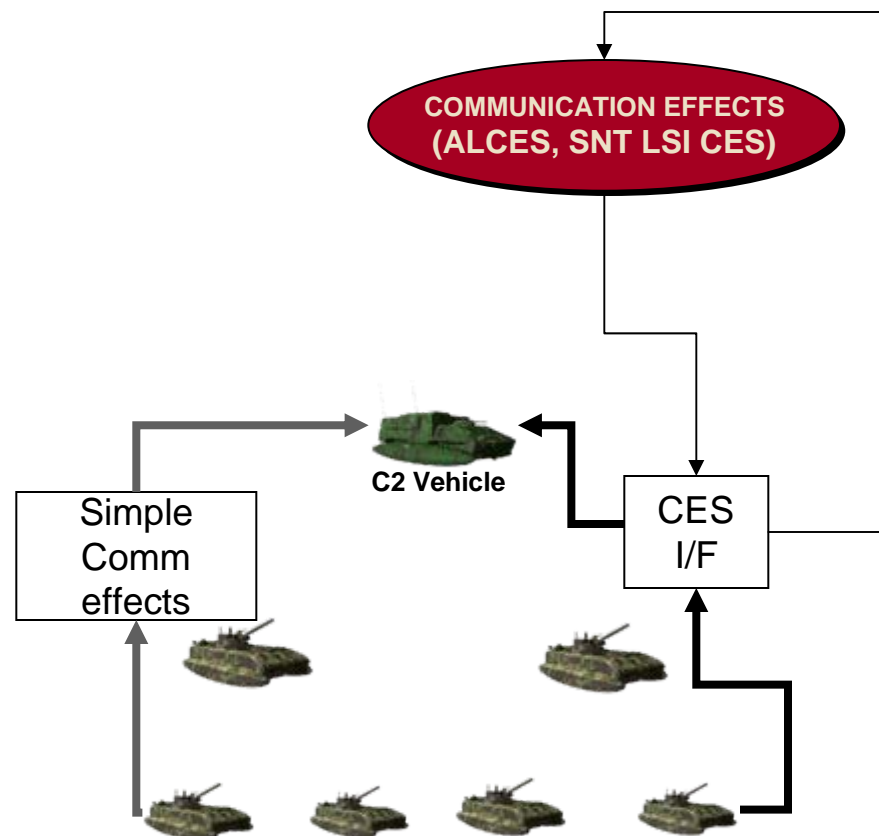
- Support for Blue Situation Awareness Initialization
- Support for Fusion
- Support of FCS LSI SNT CES v4.0 (new interface)
- GUI interface

*TECHNOLOGY DRIVEN.* **WARFIGHTER FOCUSED.**

- # RDECOM (RDEC's)

  - Aviation and Missile Research, Development and Engineering Center (AMRDEC)

  - Armament Research, Development and Engineering Center (ARDEC)

  - Army Research Laboratory (ARL)

  - Communications-Electronics Research, Development and Engineering Center (CERDEC - Belvoir/Monmouth)

  - Edgewood Chemical Biological Center (ECBC)

  - Natick Soldier Research, Development and Engineering Center (NSRDEC)

  - Simulation & Training and Technology Center (STTC)

  - Tank and Automotive Research, Development and Engineering Center (TARDEC)
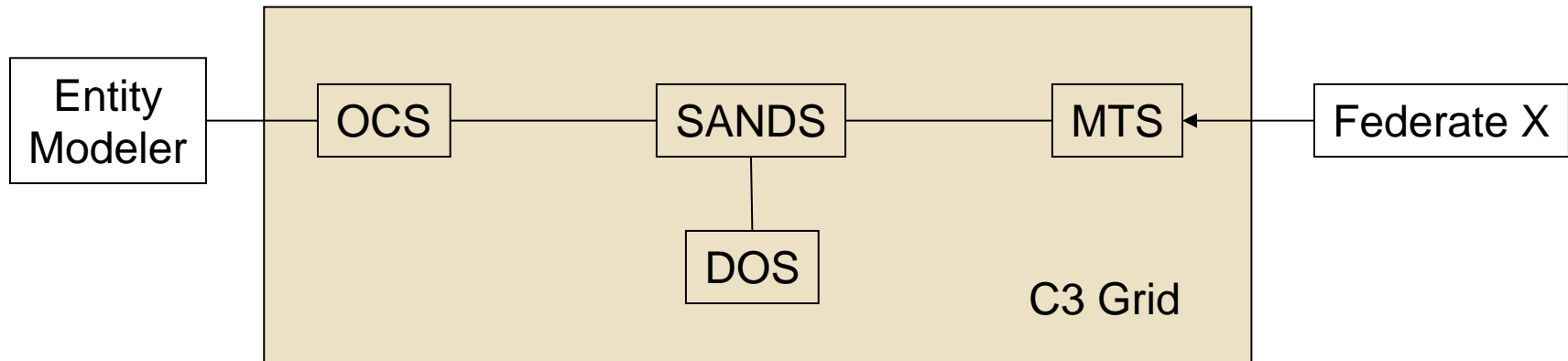
- # FCS LSI

- # BLCSE (MMBL and TRADOC)

- # PM C4ISR On-The-Move

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

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MATREX IDE Website: **https://www.matrex.rdecom.army.mil**

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
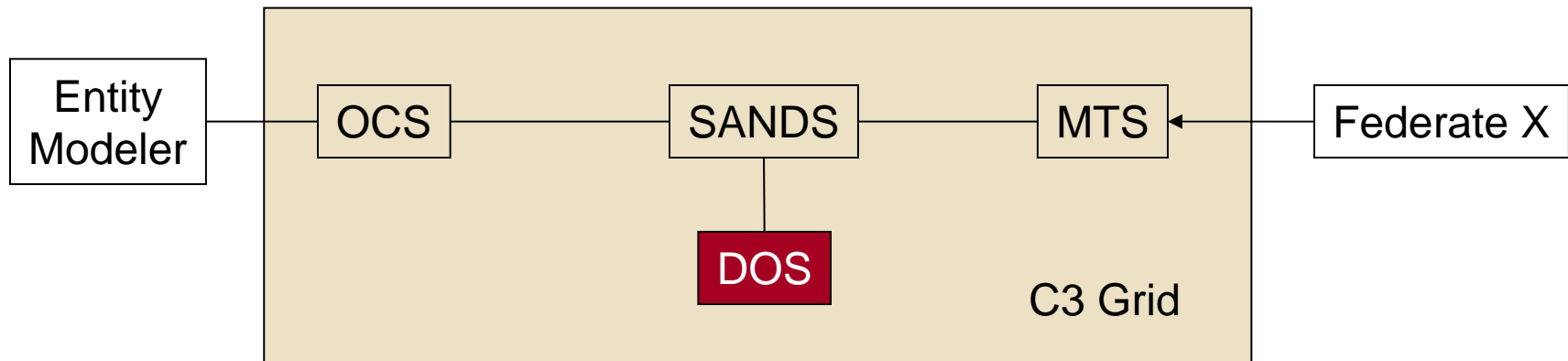
# Backup

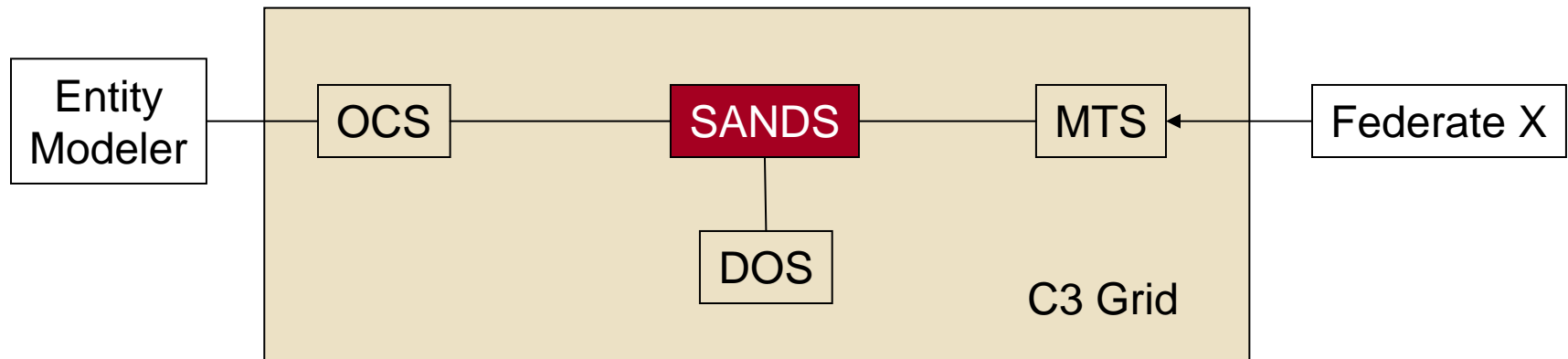TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

- **OCS** – Organic Communication Service
- **DOS** – Dynamic Organization Service
- **SANDS** – Situational Awareness Normalization & Dissemination Service
- **MTS** – Message Transceiver Service
- **R2S** – Role Resolution Service

TECHNOLOGY DRIVEN. **WARFIGHTER FOCUSED.**
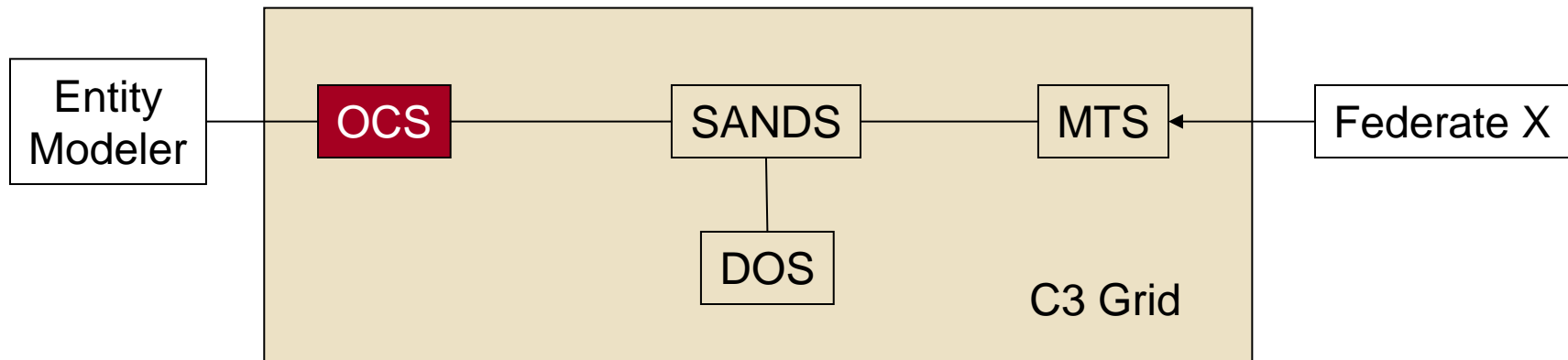
- ## OCS – Organic Communication Service
- ## OCS provides a filter mechanism from outside models to the C3Grid
  - Provides and abstraction layer between the interactions of the C3Grid components and the simulation architecture.
  - The OM used by the C3Grid remains flexible because it is isolated from the exercise.  As new interfaces are defined only the abstraction layer defined within OCS needs to be changed.

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

Diagram: Entity Modeler — OCS — SANDS — MTS — Federate X, with DOS connected below SANDS, all within the "C3 Grid" box.

- ## DOS – Dynamic Organization Service

- ## DOS manages the C3Node structure in the C3Grid
  - The C3Node is a mechanism to combine "who talks to whom" and "who acts on what"
  - DOS initializes the C3Node Architecture in an exercise
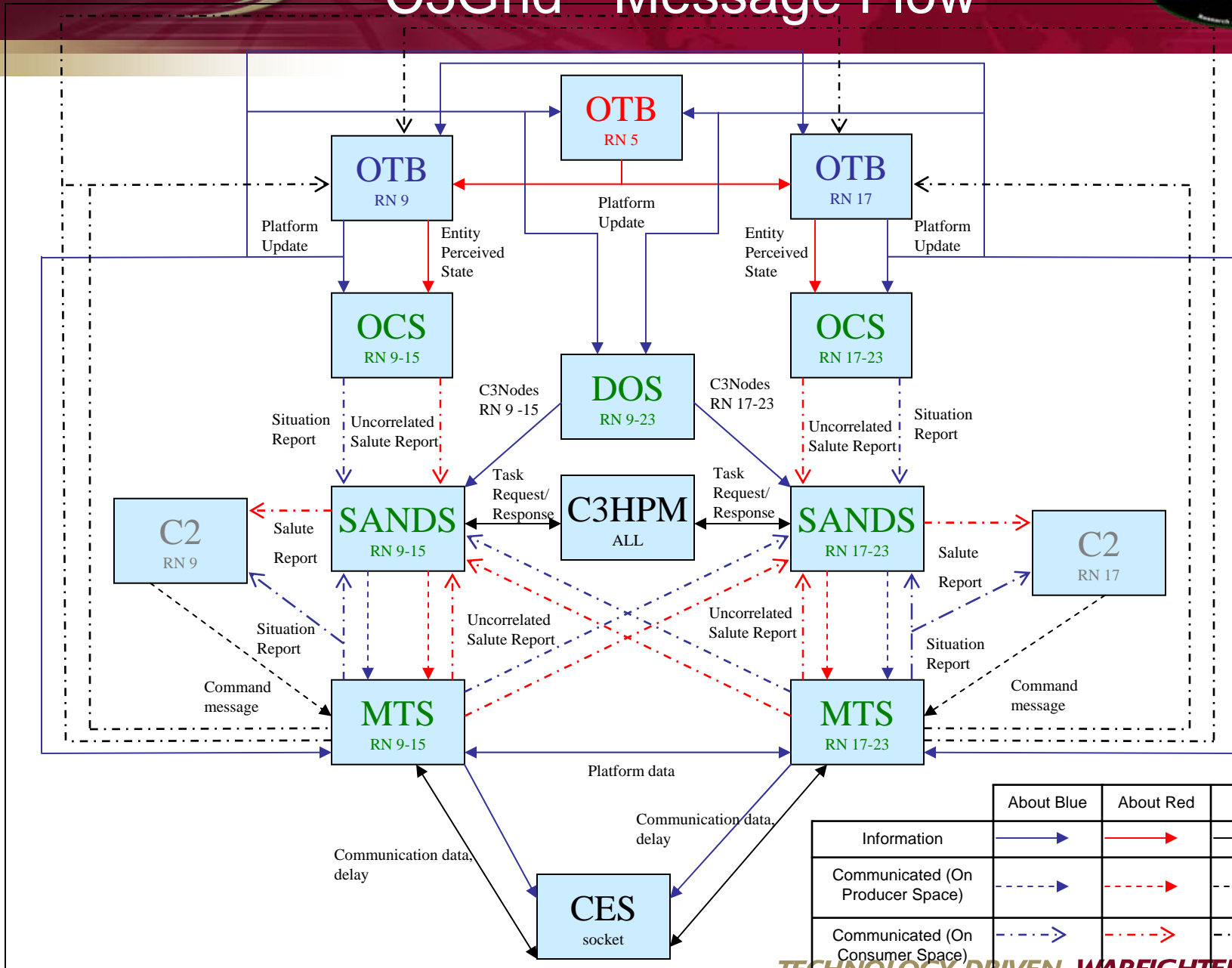  - During the exercise, DOS manages command succession and proper message flow

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

- **SANDS** – Situational Awareness Normalization & Dissemination Service
- SANDS manages (or coordinates the management of) the local operational picture (LOP) for each simulated platform
  - Interfaces for fusion, human performance modeling, message generation and the proper dissemination of information
  - Messages needing comms effects are sent to MTS  Information from the entity to itself are processed within SANDS.
  - SANDS acts on behalf of the simulated entities by managing information flow from them and to them

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
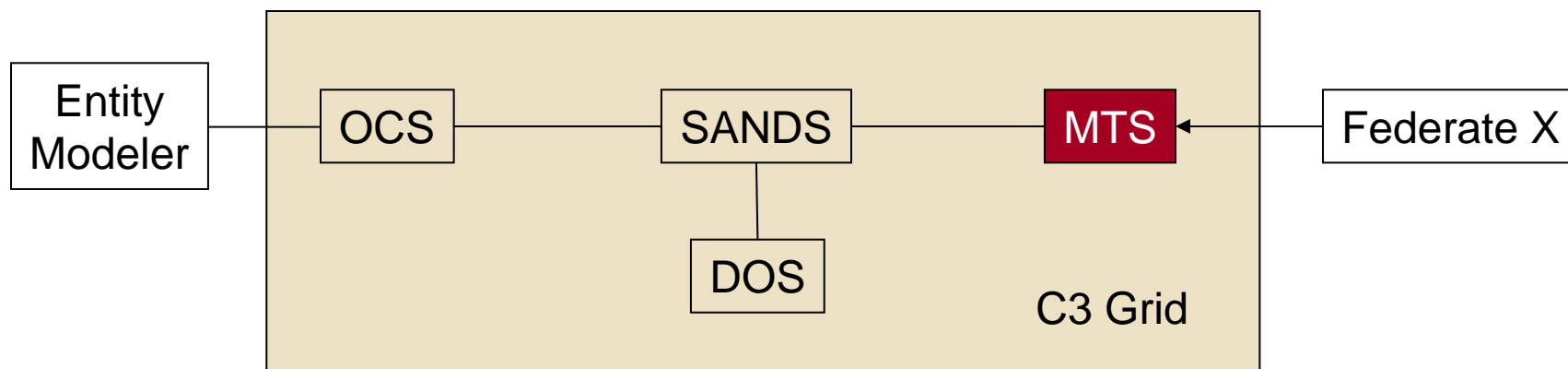
- # MTS – Message Transceiver Service
- # MTS allows for realistic modeling of radio and network communications
  - – MTS interfaces with the CES for proper modeling of communications equipment
  - – MTS routs messages to the proper receiver.  A message with multiple receivers will be copied and sent with appropriate comms effects in MTS

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

| | About Blue | About Red | N/A |
|---|---|---|---|
| Information | →(blue) | →(red) | →(black) |
| Communicated (On Producer Space) | -->(blue dashed) | -->(red dashed) | -->(black dashed) |
| Communicated (On Consumer Space) | -·->(blue) | -·->(red) | -·->(black) |

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.